Friday, September 17, 2021

ON THE ETHICS OF PLANETARY ENGINEERING

Introduction

I have spent most of the past five years trying to address global climate change from a mitigation technology perspective. This effort on my part derived in large measure from my own experiences solving industrial contamination issues at all scales and thereby preventing environmental problems from continuing to happen at least on a limited basis.

Debating whether global climate change was fact or fiction did not enter my decisions. I assumed it was real because I was told to do so. What I didn't know was its severity or when it might start or end. Time and others' efforts revealed those realities to me. Global climate change's reality will be severe, and it has already begun. I had hoped it's effects would be linear and predictable. Those effects have been proven to be chaotic and unpredictable. Its duration will be long from a human society perspective and will likely last for centuries and more likely millennia. Human society and our global biota may not survive its effects.

Combating those effects will require a unified global effort on a scale human society has never imagined. Mitigating or reversing those global effects will be difficult at best. At worst, if nothing significant is done on a global basis, we could experience an extinction level event for ourselves and every living thing around us. This is a worst-case reality that I refuse to accept.

A couple of years ago, I began to fully appreciate the sheer scale of the issues and understand that their "knock on" or unintended consequences are appreciable

and if not properly addressed beforehand they too could be catastrophic and additive to the rapidly emerging nightmare of global climate change.

Geoengineering, planetary engineering, and terraforming as terms began to be a “thing” about then as well on social media. Nobody, and I mean nobody, grasped what would be needed to even begin to address global climate change in a meaningful way. It seemed and still does seem that the human mind or its collective societies hasn’t grasped the concept. I refuse to believe that we cannot grasp this concept. We simply must grasp and accept it. How that is made to happen is thankfully up to others I do not now know and will likely never meet.

My numerous topical reports have addressed many of the facets of global climate change mitigation and its supporting technologies. I say technologies because I realize that technical solutions properly applied will mitigate or largely solve or at worst control the effects of global climate change so that human society and our global biota can survive in some sense. Organic solutions while attractive from an uninformed perspective will not and cannot address planetary scale issues in anything other than geologic timescales of megayears.

The topic of ethics regarding planetary engineering may seem unimportant or irrelevant. Its not. If we had carefully weighed, with foresight, which is not a reliable human societal perception, our reliance on a hydrocarbon based global society, this issue of global climate change might have been avoided. That milk has been spilt forevermore unfortunately. Now we must solve the problem.

Background

As is often the case for me, I rely on others to provide background for my design concepts, conclusions, and assorted notes. This report will not have design concepts or notes because they have been done already. Conclusions are the objective of this report. Avoiding unintended consequences for our first global or planetary engineering project(s) requires some level of ethical rigor as well.

First, a reasonable short explanation of ethics done by another will serve to establish some basic background:

"Ethics is sometimes seen as directed to the true moral laws or rational precepts of conduct, and sometimes as an inquiry into the ultimate end of reasonable human action—the good or 'true good' of man—and how to achieve it. Both views are familiar and will be carefully considered; but the former looms larger in modern ethical thought and is easier to connect with modern ethical systems generally. For the *good* investigated in ethics is limited to good that is at least partly attainable by human effort; so, knowledge of the end is sought to discover what actions are right for achieving it. Thus, however prominent the notion of an ultimate good may be in an ethical system, and however we interpret this notion, it won't be any use to us unless we can discover some rules for telling us how to behave.

On the other hand, the idea of ethics as an investigation of man's 'ultimate good' and how to achieve it doesn't easily connect with what I'll call the 'intuitional' view of morality—the view that conduct is right when it conforms to certain precepts or principles of duty that are intuitively known to be unconditionally binding."

So, from my perspective, what better "ultimate good" can we pursue than our global society's survival? We do also have a unique opportunity to determine now, deliberately, what steps we must take to achieve that survival.

A perspective by another worth review:

"It was not so long ago that the civilizations of the world were isolated from one another by the vast distances between them. However, whether lured by the prospect of economic gains, or forced by the pressures from within, these civilizations were forced to expand, taming the lands and oceans which separated them. As a result, these islands of civilization have merged and now encompass islands of wilderness on our finite globe."

Decisions got made from limited perspectives most assuredly and we've now got what we have. Changing that perspective and driving toward a plan to change our future seems like it's a requirement for our survival.

A definition worth review by another:

"Let us begin by defining terraforming as *the intentional application of anthropogenic forcing to a planetary environment to effect a desired climactic change*. This can be viewed as global environment engineering and as such may require substantial maintenance even in steady state. Many of the methods of terraforming are broadly applicable and may be used in the context of any planetary body with an atmosphere, oceans, or other radiative sinks. As well, the lessons of this thought experiment are applicable not only to other planets, but also to the earth (for instance to avoid the recurrence of a 'snowball-earth' event or a catastrophic 'run-away greenhouse' effect).

Another item which should be kept in mind during this paper is the magnitude of the quantities involved. Naturally, the energy and mass transport required to remake the climatology of a planet are immense and as such in the early part of the space era (early 1950s to mid 1970s), terraforming was largely the domain of science fiction.

The methods used to change a planet's atmosphere and eventually alter its ecosystem are not perfectly understood by scientists today, even on Earth. Yet as the issue of climate change on Earth has shown, humans have a very great impact on the planet they inhabit. It is not a large step beyond this to consider attempting this interference purposefully."

It becomes obvious, I think, that using the term planetary engineering or "terraforming" begins to make better sense when an appreciation of the sheer

scale of the endeavor becomes commonly accepted. Global climate change is just another facet of planetary engineering or terraforming. An unintended consequence.

We have been given a gift we are just now beginning to understand:

"It is not surprising that there are no locales in space yet discovered which are habitable. Humans live within, and are part of, the Earth's biosphere which can be viewed as a biogeochemical life-support system englobing the planet and extending from the top of the atmosphere to substantial depths within the crust. There are no other Earths in the Solar System which duplicate these conditions and they would already be inhabited by some sort of life if there were. Thus, the challenge of space settlement involves the creation of artificial and autonomous biospheres which can resist or adapt to local barren conditions. Here we have the reason why settlement lags at least four decades behind travel and remains to happen: the science of life-support systems is much more complicated and poorly understood than rocket science.

Nevertheless, space remains an energy and material rich frontier and there have been several technical assessments of space as an arena for human endeavor since the dawning of the Space Age. The most well-known of these are the proposals of O'Neill and followers in the 1970s which involve the fabrication (from lunar or asteroid materials) of large orbiting habitats, spun to create artificial gravity and landscaped on the interior, providing a quasi-natural environment. Originally, it was envisaged that these habitats would house workers building solar power satellites for Earth. But if the initial operations could be made to pay, it was natural to predict the more self-sufficient of these orbiting city states adopting a more independent course and moving away from the environs of Earth altogether. Humanity would have evolved into a spacefaring civilization."

Another perspective by others from some decades ago:

"Our planet is slowly warming up because of our overindulgence in fossil fuel energy. This scientific fact is known and accepted by politicians and public alike. The profligate combustion of fossil fuels, giving rise to ever-increasing amounts of carbon dioxide, has produced the Greenhouse Effect by preventing radiation into space of the heat generated on Earth. This is nothing new: it began when the first

caveman lit his wood fire. However, today's massive combustion is leading to a gradual warming of the Earth, an irreversible phenomenon. There is no known way of cooling the Earth, nor can the oceans' levels be lowered once the polar icecaps and glaciers have started to melt in earnest. To arrest the Greenhouse Effect here and now would mean stopping all oil-driven transportation and extinguishing all fires under the boilers of fossil-fueled power stations. Without motor cars and without electricity, our present civilization would cease to exist. We have caused a deterioration of our planetary environment that cannot be made good again. At present the size of the Greenhouse Effect and its time scale are not yet accurately known, and the best available estimates postulate a temperature rise of 1.5 to 4.5 °C over the next 50 years. Alternative energy sources, renewable, carbon-free, and unlimited, are provided by nature and will be considered in some detail below. However, all these are still in the future and, where already used, are circumscribed by quite inadequate financial and political support. Global warming affects the whole Earth, and only planetary engineering can provide a solution if it is now seriously undertaken."

Without meaning to be too boring yet another perspective:

"A variety of claims have been made concerning the future of ecopoiesis (starting an ecosystem) and terraforming (creating an earth-like environment) – highly controversial subjects. Planetary protection is a significant component of the ecopoiesis debate. One of the significant outcomes of performing research in this area is expected to be the informing of a scientific community consensus concerning these subjects.

Today's thinkers hold varying opinions concerning ecopoiesis, the process of evolving a physical and biological environment that can lead to "terraforming" – the deliberate introduction of terrestrial-type ecosystems on remote celestial bodies such as planets, moons, and asteroids (Haynes, 1990). On one extreme, principles of planetary protection prohibit the introduction of any living organisms onto Earth's neighbors in the solar system while, on the other extreme advocates of terraforming propose the early modification of Mars (for example) to initiate processes that will make the planet a more hospitable place for humans should they decide to go there (Zubrin and Wagner, 1996). Either way, knowledge is lacking, and experimental testing is non- existent, related to the basic understanding of the ecopoiesis process. Since the implementation of any concepts related to ecopoiesis would occur several decades in the future, the experimental study of ecopoiesis now would seem an ideal objective. While ethical considerations are outside the scope of this presentation, such a research program could inform this debate.

It is of great value to cause the visions of the prophets of the field to be extended an entire century forward. Meanwhile, a series of benign, but difficult experiments (laboratory, field, and theory) can and should be performed. The undertaking of ecopoiesis/terraforming research can be considered a direct response to the challenge originally put forth by Christopher McKay and the late Robert Haynes: "if it is decided to implement such a program of planetary engineering, a slow and conservative approach is essential. Sufficient time must be allowed for a wide range of studies of Mars as it exists at present, and for careful planning, modeling and 'pilot-plant' trials (where possible) of all successive steps in the enterprise." (Haynes & McKay, 1995). This challenge calls for research that includes biological experiments and theoretical modeling directed at the implementation of the enabling notions in terraforming offered by Fogg (1995), McKay et al. (1991), and Boston and Thompson (1991) among others. To date, only individual components of ecopoetic systems have been investigated – a few species of microorganisms and certain primitive and vascular plants.

As mentioned earlier, terraforming requires an immense amount of time and resources. The first step of extraterrestrial global warming requires the presence or introduction of greenhouse gases on the surface of a target planet. Once these needed gases are present in ample amounts, the process of global warming can take up to 100,000 years to raise the surface temperature above water's freezing point. Once this temperature is achieved, the next step involves introduction of Earth species for oxygen production. While some organisms that can tolerate low temperatures can be introduced before the desired temperature is reached, most organisms would have to wait. Depending on the size of the planet, an incredible number of photosynthetic organisms would have to be transferred from Earth to the target planet for oxygen production. Even with an ample number of organisms, it would take around 100,000 years to produce enough oxygen to reach the needed concentration of atmospheric oxygen for human survival.

Another issue arises when looking at suitable planets for terraforming: the possibility of life already existing on the planet. Because planets suitable for terraforming require an atmosphere and certain compounds to be present, the possibility of life already existing on these planets is high. This raises the ethical question of whether humanity has the right to change the atmosphere of a planet already home to living organisms to an atmosphere that would result in the death of those organisms (Schwartz, 2013). The speed and scale at which this change is induced would not allow for adaptation of these organisms, and ultimately lead to their extinction."

Conclusion

We have a unique opportunity in front of us. If we are deliberative and inclusive as a global society, we can largely mitigate and control the effects of global climate change. The ethics or politics of this planetary engineering project must be fully understood and adopted by our global society, or it will fail. No one country or even a large set of countries can do this project on their own. It is too large, too complex and if not approached with a solid plan that is properly financed and researched it will fail.